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## VI. *A Deſcription of the* Apparatus *for making Experiments on the Refractions of Fluids: With a Table of the Specifick Gravities, Angles of Obſervations, and Ratio of Refractions of ſeveral Fluids.*

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THE whole *Apparatus* is fix'd on a Table, parallel to its Surface. On one and the ſame *Axis* is fix'd a Sextant, of a *Radius* of 4 Feet, and a moving Limb to bear the Object. The Sextant is divided into Degrees and Minutes by a Diagonal, and remains always fixt. The Object, which is plac'd on the moving Limb, is ſeen parallel with the Table when obſerv'd through the Priſm, and at no Degrees on the Sextant; but when any Tranſparent Liquid is put into the ſame, the Object muſt be elevated till it appears to the Eye: Then obſerving how many Degres and Minutes the *Index* on the Limb cuts on the Sextant, we note it, and call it the Angle of Obſervation. Thus for different Liquids you have different Elevations of the Object, as you will find by the following Table. The Sight-Slit (if I may call it ſo) is compoſed of two pieces of Box Wood, plan'd parallel to one another: Theſe Pieces are ſeparated only by 3 ſlender Slips of common Cards; and with that Intervention are ſcrew'd down one upon the other, exactly parallel with the *Axis* of the moving Leg and Sextant. The Prizm, thro' which it directs the Sight, is plac'd pretty near it, and conſiſts of an Angle of $44^{d}.54^{\prime}$, which Angle is fix'd Perpendicular to the Plane of the Table,

its

its upper ſide being parallel with the ſame. The Object is a Piece of white Paper, in form of a Croſs, paſted on a black Board, and is fix'd at the end of the moving Limb, which is in length about 7 Feet from the Sight; its Diameter is about 2 ½ Inches, which juſt comprehends the Sight through the Slit; ſo that when the Object is wholly within view, we conclude the Obſervation to be exact. With this *Apparatus* the Experiments are made as well by Candle-light as Day-light, (the Preſence of the Sun Beams being no ways neceſſary) and I think they may be depended on as pretty Accurate. I have taken the Specifick Gravity of the ſeveral Liquids, where I could obtain a ſufficient quantity, as appears by the Table: So that if any Perſon ſhould have the Curioſity to repeat theſe Experiments, he muſt expect a different Angle of Obſervation, if the Specifick Gravity agree not with the Table; for ſometimes it happens, that Liquids of the ſame Denomination are not always of an equal goodneſs, and conſequently will have a different Specifick Gravity and Refraction.

The Chriſtalline Humour of the Ox Eye I preſt into the Angle of the Priſm, whereby it received the form of it, and gave the Angle of Obſertvaion, as ſpecify'd in the Table. I could not ſee the common Object thro' it, but was forc'd to make uſe of a Candle for that purpoſe; the Flame whereof appeared very broad, at leaſt 5 or 6 Inches, nearly in the form of a Half Moon: But what ſhould occaſion ſuch a Change of Figure, I cannot at preſent determine. Of all the Fluids I have try'd, I find nothing to Refract a Ray of Light leſs than Water; yet there are ſeveral other Liquids which make the ſame Angle. I obſerve Oil of Bees-Wax to be the lighteſt Fluid, and Butter of Antimony *per Deliquium* to be much the heavieſt: The difference of Specifick Gravity between theſe two Bodies, is as 662 is to 1976, that is, nearly as one to three: And the Ratio of their Refractions but as 10000 is to 6885 Bees-Wax, ſo is 5941 Antimony to the ſame *Radius*; that is, as one to 1.16, or thereabouts. Likewiſe Oil of Vitriol is in Specifick Gravity to Oil of Saſafras, as 1510 is to 898; yet the *Ratio* of Refraction of the lighteſt is moſt conſiderable, being in proportion as 10000 is to 6475 Saſafras; ſo is the ſame *Radius* to 7011 Vitriol. Thus I find, that a Body doth not Refract in proportion to its Specifick Gravity, but from ſome quality peculiar to its ſelf; whether it be from its Inflammability, or from any different Texture, or Figure of its Component Parts; or whatever elſe it be, I ſhall, with the Application of theſe Experiments, ſubmit to this Honourable Society to determine.

| | Specifick Gravities in compariſon with a bulk of Water equal to 820 Grains | Angle of Obſervation. d. ' | Ratio of Refraction, as 10000 is to |
|---|---|---|---|
| | | 16.50 | 7485.3 |
| Oil of *Saſafras* | 898 | 29.20 | 6475.8 |
| *Turpentine* | 713.5 | 25.25 | 6741.8 |
| *Bees-Wax* | 662 | 23.30 | 6885.4 |
| *Carawayes* | 752 | 26.13 | 6696.5 |
| *Oranges* | 711 | 25.20 | 6741.2 |
| *Hyſop* | 769.5 | 25.10 | 6757.6 |
| *Roſemary* | 747 | 24.40 | 6794.7 |
| *Savin* | 789 | 25.30 | 6730.9 |
| *Origanum* | 752 | 25.00 | 6770.2 |
| *Pennyroyal* | 783 | 25.30 | 6730.9 |
| *Mint* | 780.5 | 26.00 | 6706.4 |
| *Spike* | 749 | 24.30 | 6807.3 |
| *Fennel* | 798 | 27.10 | 6616.5 |
| *Juniper* | 729 | 25.10 | 6757.6 |
| *Cummin* | 766.5 | 27.00 | 6627.7 |
| *Tanſey* | 757 | 23.46 | 6865.1 |
| *Dill* | 795.5 | 27.40 | 6582.7 |

Oil

| | | | |
|---|---|---|---|
| Oil of *Amber* | 783 | 26.30 | 6662.3 |
| *Cinnamon* | 828 | 28.40 | 6517.7 |
| *Cloves* | 827 | 27.20 | 6606.8 |
| *Nutmegs* | 759 | 25.40 | 6721.4 |
| Spirit of *Wine* | 703.5 | 18.50 | 7287.9 |
| *Hartſhorn* | 786 | 17.00 | 7468.3 |
| *Vinegar* | 824.5 | 17.00 | *As Hartſhorn.* |
| *Sal Armoniack* | 794.5 | 16.56 | 7475.2 |
| *Acids*, Spirit of *Amber* | 825 | 16.56 | *As Sal Armon.* |
| Oil of *Vitriol* | 1510 | 21.56 | 7011.5 |
| Spirit of *Nitre* | 1166 | 20.50 | 7104. |
| *Aqua Regis* | 987 | 19.50 | 7195. |
| *Aqua Fortis* | 1157 | 2040 | 7120.5 |
| *Aqua Regis* from *Aqua Fortis* and *Sal Armoniack* | 1034 | 20.10 | 71615 |
| Butter of *Antimony* | 1976 | 40.00 | 5941.3 |
| Spirit of *Raw Silk* | 916 | 20.30 | 7135. |
| Spirit of *Honey* | 716 | 16.50 | *As Water.* |
| Tinct. of *Antimony* | 693 | 18.46 | 7294.3 |
| *Jeſuits Bark* | 720 | 18.46 | *As Tinct. of Ant.* |
| *Balſ. Tolu* | 717 | 19.34 | 7219.3 |
| *Gum Amoniacum* | 719 | 19.10 | 7257.3 |
| *Mettals* | 713 | 18.54 | 7281.7 |
| *Vitreous Humor of an Oxes Eye* | | 16.50 | *As Water.* |
| *Chriſtalline Humor of the Ox Eye* | | 24.10 | 6832.7 |
| *White of an Hens Egg* | | 17.40 | 7401.3 |
| *Jelly of Hartſhorn* | | 17.50 | 7384.7 |
| *Human* Saliva | | 16.50 | *As Water.* |
| *Human Urin* | | 17.05 | 7451.9 |
| *French Brandy* | | 18.20 | 7338.6 |

Oil of Turpentine ſtrongly ting'd Green, with filings of Braſs, no ways alters its Refraction.